

Helping Students with Disabilities Become Writers

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For students with severe disabilities, the journey to independent writing is no longer an impossible dream.



Courtesy of the Maryland School for the Blind

Two students use *Intelletalk* to spell the names of continents. One uses a large alphabet display; another a Braille keyboard. The ECHO synthesizer speaks the letters and pronounces the words.

Rebeka, a bright, articulate 9-year-old, is writing a letter to Gloria Estefan, her favorite singer. The only difference between Rebeka and any other fan is that she is blind and has cerebral palsy.

While Rebeka is an avid Braille reader, she is unable to use a Braille for writing because of her motor difficulties. (Both manual and electronic Braille require the user to depress more than one key simultaneously.) Rebeka instead uses a standard computer keyboard with Braille "sticky" overlays on each key. Using a word processing program with speech feedback, she monitors her writing by listening to the words as she encodes them. Like her classmates, Rebeka is expected to engage in daily authentic writing tasks, including writing in her journal and drafting, critiquing, and editing her work.

For students with severe motor and speech impairments, learning disabilities, hearing impairments, or visual impairments, the journey to becoming effective, independent writers is no longer insurmountable. More and more success stories are pouring in about how technology, combined with effective practice, can help students with disabilities overcome barriers to their success.

Students with Motor or Speech Impairments

Imagine the challenges faced by Jeff, a bright and energetic high school freshman mainstreamed for regular education classes. Jeff has motor impairment that significantly affects his speech and motor skills. For Jeff, handwriting has always been an excruciating process because his

pencil grasp is awkward and letter formation is slow and inexact. Because of learning disabilities, Jeff also has difficulty organizing his ideas and expressing them in complex sentences. The combination of these factors has made independent writing an overwhelming task.

Throughout elementary school, Jeff relied on his teachers and his parents to physically write for him. As Jeff dictated his written work, his "scribes" helped him translate his sometimes disorganized thoughts into coherent language. While this process enabled Jeff to partake in mainstream instruction, it interfered with his ability to develop independent writing skills.

At the suggestion of specialists at a local hospital, Jeff now uses a portable laptop computer with a speech synthesizer and a specialized word processing program. This combination of hardware and software has several compensatory features that address Jeff's deficit areas.

Word prediction and *abbreviation expansion*, for example, help Jeff circumvent the fine-motor and spelling demands of writing. As each letter in a word is typed, a list of words beginning with those letters appears in a window. The target word can be chosen from this window and inserted with a single keystroke. With *abbreviation expansion*, entire messages can be encoded and retrieved with a simple keystroke combination. For example, Jeff can access his name and address by typing Ctrl-J. *Speech feedback* enables Jeff to monitor and edit his writing, and special keyboard settings that accommodate his slower rate of releasing keys eliminate the problem of repeating letters.



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Because Jeff's expressive language-formulation skills are underdeveloped, writing is still a slow process. He is, however, answering his own homework questions now and writing letters, stories, and reports. At the end of 8th grade, Jeff was asked by his English teacher to research a subject of personal interest and prepare an oral report. Historically, Jeff had dreaded such assignments because they highlighted both his writing and speaking difficulties. But now Jeff had a tool!

After carefully researching the history of the Boston Red Sox, he wrote an outstanding report, full of fascinating, little-known facts. When it was Jeff's turn to present his report, he walked to the front of the class, booted his laptop, and "spoke" it sentence by sentence through the speech synthesizer (see fig. 1). Jeff's classmates were fascinated by the information, but even more amazed by Jeff's hidden talents!

Many individuals who have more severe motor impairments than Jeff cannot use a standard keyboard.

Plastic keyguards placed over the keyboard, however, enable individuals with limited arm or hand function to access individual keys with greater precision. For students without control of their arms or hands, headsticks, mouthsticks, or customized hand-held pointers enable them to directly select from the keyboard. Alternative keyboards of various sizes and configurations can aid some individuals with reduced fine-motor ability or limited range of movement. With specialized software, students who are unable to select keys directly from a standard or an alternative keyboard can access a computer via a single switch.

As long as students can make a consistent, reliable movement, the computer is a viable option. Many individuals successfully operate computers by activating a switch with their head, foot, mouth, or the blink of an eye. The power of these hardware alternatives increases when coupled with software applications that reduce the number of keystrokes necessary for encoding, such as word prediction

and abbreviation expansion.

For students with severe speech impairment, speech feedback with word processing can significantly bolster writing development by supporting their attempts to reread as they compose and edit their written messages. In this way, they become increasingly adept at independently monitoring vocabulary and grammar.

Students with Learning Disabilities

A decade ago, word processors began making their way into the classrooms of students with learning disabilities. Researchers and practitioners began documenting the benefits of word processing, spelling checkers, grammar checkers, and speech synthesizers for this population (Morocco et al. 1992, MacArthur 1988). By easing the physical burdens of writing, computers with word processing helped students express themselves, monitor their writing, and partake in the processes essential to good writing. Research findings, however, began to reveal that good teaching



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practice is key to the success of word processing with learning disabled students (Zorfass et al. 1989).

Research suggests that students benefit when *strategy instruction* is integrated with word processing (MacArthur et al. 1991). In strategy instruction, teachers provide explicit direction in planning, writing, and revising. For example, Mrs. Lee, a teacher who participated in a study of technology use with learning disabled students, integrated word processing into her 8th grade reading and writing program (Storeyard et al. 1993). Before students began drafting on the computer, Lee guided them through brainstorming activities, such as webbing, both on and off the computer.

Another advantage of word processing is the public visibility of the text on the monitor, promoting discussion between students and teachers as the writing process unfolds (Montague and Graves 1993, Morocco and Neuman 1986). For example, as Lee circulated around the computer lab while students drafted their stories, she could discuss ideas, spontaneously prompt revision, and provide individual instruction.

In a similar vein, the accessibility and legibility of computer-generated text encourage collaborative writing and editing. For example, Lee grouped her students based on their complementary strengths and weaknesses. She then modeled cognitive strategies for critically analyzing successive drafts. When students completed final drafts, she encouraged them to reflect on themselves as authors and the role technology played in the authoring process (Zorfass 1992).

Students with learning disabilities often have difficulty carrying out sustained writing projects such as research reports, which are often a "rite of passage" in middle and high school. Education Development Center, Inc., is currently developing a software program, *Search Organizer*, that supports middle school students through a systematic process of (1) identifying a research question, (2) developing a search plan, (3) gathering and integrating information, and (4) writing a report. *Search Organizer* currently runs on a laptop computer that moves easily from classroom to classroom (Zorfass, in press). By the time students are ready to begin writing their reports, they

have a first draft, which the computer has created by integrating the information students have gathered during the search process.

Students with Hearing Impairments

For students with significant hearing loss, learning to write follows a unique developmental course. Whereas hearing children translate the oral language they have heard since birth into written language, children who are hearing impaired have not had full access to oral language. Some may develop ASL (American Sign Language) as their native language. The fundamental question becomes: How can deaf and hearing-impaired students become writers of English when their first language has a different linguistic structure than English?

Researchers are currently exploring ways in which technology can help students who use ASL to become writers of English. For example, The WGBH Educational Foundation and the National Technical Institute for the Deaf have been experimenting with a technique known as *personal captioning*. In this project, piloted at the Tripod School in California, elementary-age deaf students watch a video of a fable told in ASL by a master deaf storyteller. Their task is to create English captions through word processing that will subsequently be superimposed over the video.

Students advance or rewind the video, as needed. Having control over the story helps them capture the sequence of events and recall specific details. While students write, teachers review their work and encourage self-corrections. Posters remind students to check sentences for verb tense, punctuation, and so forth. Later, students review their printed captions with an

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English-language tutor, who discusses with them the meaning of the story (Kelly et al., in press).

Some deaf students have difficulty appreciating that written language is a tool that allows communication with different audiences for different purposes. By using E-mail, deaf students have the opportunity to practice reading and writing as part of meaningful and purposeful learning activities. For the past five years, the Center for Children and Technology has collaborated with the Lexington School for the Deaf in New York to develop a model program for the use of local area network (LAN) technology in curriculum areas (Bell et al. 1991). High school students in this program carry out science activities by writing messages to one another over the network.

Students with Vision Impairments

Technology can assist vision-impaired writers in three important ways:

(1) by offering them alternative means of text input, (2) by helping them monitor the text while writing, and (3) by providing ready access to written products in either print or Braille form.

Keyboarding is generally straightforward. While some students use the traditional keyboard with standard touch-typing methods, others use a Braille keyboard, or nine-key device that enables them to input Braille text. Small electronic devices enable users to Braille in notes, which they can subse-

quently listen to via synthesized speech, download to a computer file, and ultimately print out in Braille or text.

However, without visual feedback, blind students often experience undue strain on short-term memory (Ely 1989). For low-vision students, hardware- or software-based text enlargers facilitate immediate visual feedback on the monitor, but generally limit the amount of text that can be viewed at one time. Word processing programs with speech feedback or screen-reading programs enable students to hear words as they are being encoded and to listen to their running text after it has been created.

A Braille display device can provide immediate "refreshable" feedback. When attached to a computer, this device translates the print display on the monitor into Braille; on an accompanying template, plastic pins pop up to form the Braille letters. The Braille display is "refreshable" because students can alter it as they change the text and advance it line by line. Such devices do require the user to toggle between two very different motor activities (keyboarding and Braille reading), which can interrupt the flow of writing. Increasingly, "bimodal" displays offer a combination of two alternate feedback mechanisms, such as speech and enlarged text.

Printing is also an important issue for a writer who is blind. For example, Rebeka, the young writer in the opening paragraph, uses a Braille translation program to print out her work on a Braille printer as well as in



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standard print format. While print files can be stored electronically and made public through print, speech synthesis, and/or visual display, blind writers need to make permanent written records for themselves.

While these adaptive tools decrease the overall cognitive demands of the writing process for visually impaired students, more traditional tools are also helpful. Because many students have limited experience with printed text, they have particular difficulty with spelling and text-based conventions such as punctuation. Programs with spell checking and grammatical monitoring can be helpful in this regard.

Beyond These Success Stories

The backdrop for each success chronicled here is a more richly textured story about *implementation*. As teachers begin integrating new technologies into their classrooms, a variety of organizational factors influence their efforts and are at the heart of each story—for example:

- administrative decision making about the appropriate placement of students with disabilities;
- the identification and purchase of

Figure 2

An Excerpt from Jeff's Report on the History of the Boston Red Sox

In 1890 some athletes formed the Players League, which did very well financially. This forced the eight National League teams and four teams from the American Association to join together for survival. In 1901 the American League declared itself a major league, moved into National League cities, and raided the older league for players. Charter members of the American League were Chicago, Boston, Detroit, Philadelphia, Baltimore, Washington, Cleveland, and Milwaukee. There was a lot of anger between the two leagues. The results of the eventual truce was the World Series, which has been played every year since 1903—except in 1904, when the New York Giants refused to meet the upstart American League champions from Boston.

specialist from Maine recently posted a story about a "text-disabled" junior high student whose abilities have been vastly underestimated and untapped. The specialist described how a history teacher recently discovered that the student can learn textbook information by listening to audiotapes and orally presented texts. The school's technology team is now exploring hardware and software applications that will provide access to a variety of textual information and enable this student to circumvent reading. One related issue that motivated considerable online conversation concerned mechanisms for "trying on" expensive equipment before purchase.

Being able to communicate knowledge, dreams, and feelings through writing is an important educational outcome for *all* students, including students with disabilities. Fortunately, a growing number of reports are showing how technology, combined with effective practice, can help these students become autonomous writers. Rebeka's father expressed a sentiment shared by all parents, "It is critical that Rebeka and other writers using Braille have a tactile document that can be shared, held, cherished—and hung on the refrigerator door." ■

If you would like to become a member of this exciting electronic conversation (and you have access to a computer and modem), please contact Denise Ethier at EDC, Network Coordinator, at (800) 225-4276, ext. 2422. She will send you the appropriate software and manual for your computer. Participation in NCIPnet is free.

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appropriate software and hardware; and

- the provision of ongoing training and technical assistance for teachers.

To increase the likelihood that every student with a disability becomes the lead character in a success story, the U.S. Department of Education (Office of Special Education Programs) has funded two Boston-based organizations—Education Development Center Inc., and WGBH Educational Foundation—to establish the National Center to Improve Practice. Our center's mission is to:

- provide current information about innovative uses of technology for students with disabilities; and
- help districts, schools, and teachers utilize this information in implementing programs.

One of our key strategies for gathering and disseminating information is a telecommunications network called NCIPnet. Members of this network include researchers, educators, parents, and others who are dedicated to improving outcomes for students with disabilities.¹

For example, a parent-information

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